

This Page Is Inserted by IFW Operations
and is not a part of the Official Record

BEST AVAILABLE IMAGES

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images may include (but are not limited to):

- BLACK BORDERS
- TEXT CUT OFF AT TOP, BOTTOM OR SIDES
- FADED TEXT
- ILLEGIBLE TEXT
- SKEWED/SLANTED IMAGES
- COLORED PHOTOS
- BLACK OR VERY BLACK AND WHITE DARK PHOTOS
- GRAY SCALE DOCUMENTS

IMAGES ARE BEST AVAILABLE COPY.

**As rescanning documents *will not* correct images,
please do not report the images to the
Image Problem Mailbox.**

WHAT IS CLAIMED IS:

1. An intermediate board comprising:

an intermediate board body having first and second faces wherein a semiconductor device is to be mounted on at least one of said first and second faces, said semiconductor device having a coefficient of thermal expansion that is equal to or larger than 2.0 ppm/°C and smaller than 5.0 ppm/°C, and having surface mount terminals, said intermediate board body having a plurality of through holes through which said first and second faces communicate with each other, said intermediate board body containing an inorganic insulating material; and a plurality of conductor columns filling said through holes and containing a conductive metal, said conductor columns being to be connected with said surface mount terminals.

2. The intermediate board according to claim 1, wherein said through holes have a diameter which is equal to or smaller than 125 μm , and a minimum center-to-center distance between adjacent ones of said through holes is equal to or smaller than 250 μm .

3. The intermediate board according to claim 1, wherein said inorganic insulating material is low-

temperature firing ceramic, and said conductive metal is at least one of copper and silver.

4. The intermediate board according to claim 1,
5 wherein a metalization layer is formed on an inner wall of each of said through holes.

5. The intermediate board according to claim 1,
wherein said inorganic insulating material is ceramic

10 which cannot be fired simultaneously with a metal material, and a metalization layer is formed on an inner wall of each of said through holes.

6. The intermediate board according to claim 1,
15 wherein said intermediate board body is made of alumina or low-temperature firing ceramic, and a thickness of said intermediate board body is 0.1 to 0.8 mm.

7. The intermediate board according to claim 1,
20 wherein said intermediate board body is made of silicon nitride, and a thickness of said intermediate board body is 0.1 to 0.7 mm.

8. The intermediate board according to claim 1,
25 wherein at least one side of said semiconductor device is

equal to or larger than 10.0 mm.

9. The intermediate board according to claim 1,
wherein said intermediate board body is made of a material
5 which is higher in rigidity than at least silicon.

10. The intermediate board according to claim 1,
wherein said intermediate board body is made of a material
having a Young's modulus of 100 GPa or higher.

11. The intermediate board according to claim 1,
wherein said inorganic insulating material is ceramic, and
said conductive metal is at least one refractory metal
selected from tungsten, molybdenum, tantalum, and niobium.

12. An intermediate board with a semiconductor
device, comprising:

a semiconductor device having a coefficient of
thermal expansion that is equal to or larger than 2.0
20 ppm/°C and smaller than 5.0 ppm/°C, and having surface
mount terminals; and

an intermediate board having: an intermediate board
body having first and second faces wherein said
semiconductor device is mounted on said first or second
25 face, said intermediate board body having a plurality of

through holes through which said first and second faces
communicate with each other, said intermediate board body
containing an inorganic insulating material; and a
plurality of conductor columns filling said through holes
5 and containing a conductive metal, said conductor columns
being connected with said surface mount terminals.

13. The intermediate board with a semiconductor
device according to claim 12, wherein said through holes
10 have a diameter which is equal to or smaller than 125 μm ,
and a minimum center-to-center distance between adjacent
ones of said through holes is equal to or smaller than 250
 μm .

14. The intermediate board with a semiconductor
device according to claim 12, wherein said inorganic
insulating material is low-temperature firing ceramic, and
said conductive metal is at least one of copper and
silver.

15. The intermediate board with a semiconductor
device according to claim 12, wherein a metalization layer
is formed on an inner wall of each of said through holes.

16. The intermediate board with a semiconductor

device according to claim 12, wherein said inorganic
insulating material is ceramic which cannot be fired
simultaneously with a metal material, and a metalization
layer is formed on an inner wall of each of said through
5 holes.

17. The intermediate board with a semiconductor
device according to claim 12, wherein said intermediate
board body is made of alumina or low-temperature firing
10 ceramic, and a thickness of said intermediate board body
is 0.1 to 0.8 mm.

18. The intermediate board with a semiconductor
device according to claim 12, wherein said intermediate
15 board body is made of silicon nitride, and a thickness of
said intermediate board body is 0.1 to 0.7 mm.

19. The intermediate board with a semiconductor
device according to claim 12, wherein at least one side of
20 said semiconductor device is equal to or larger than 10.0
mm.

20. The intermediate board with a semiconductor
device according to claim 12, wherein said intermediate
25 board body is made of a material which is higher in

rigidity than at least silicon.

21. The intermediate board with a semiconductor device according to claim 12, wherein said intermediate board body is made of a material having a Young's modulus of 100 GPa or higher.

22. The intermediate board with a semiconductor device according to claim 12, wherein said inorganic insulating material is ceramic, and said conductive metal is at least one refractory metal selected from tungsten, molybdenum, tantalum, and niobium.

23. A substrate board with an intermediate board, comprising:

a substrate board having a coefficient of thermal expansion that is equal to or larger than 5.0 ppm/°C, and having surface mount pads; and

an intermediate board having: an intermediate board body having a first face and a second face which is mounted on a surface of said substrate board, said intermediate board body having a plurality of through holes through which said first and second faces communicate with each other, said intermediate board body containing an inorganic insulating material; and a

plurality of conductor columns filling said through holes and containing a conductive metal, said conductor columns being connected with said surface mount pads.

5 24. The intermediate board with a semiconductor device according to claim 23, wherein said intermediate board body is made of a material which is lower in coefficient of thermal expansion than said substrate board.

10 25. A structural member comprising:
a semiconductor device having a coefficient of thermal expansion that is equal to or larger than 2.0 ppm/°C and smaller than 5.0 ppm/°C, and having surface mount terminals;

15 a substrate board having a coefficient of thermal expansion that is equal to or larger than 5.0 ppm/°C, and having surface mount pads; and

20 an intermediate board having: an intermediate board body having a first face on which said semiconductor device is mounted, having a second face which is mounted on a surface of said substrate board, and having a plurality of through holes through which said first and second faces communicate with each other, said
25 intermediate board body containing an inorganic insulating

material; and a plurality of conductor columns filling said through holes and containing a conductive metal, said conductor columns being connected with said surface mount terminals and said surface mount pads.

5

26. A method for producing an intermediate board, said intermediate board comprising: an intermediate board body having first and second faces wherein a semiconductor device is to be mounted on at least one of said first and second faces, said semiconductor device having a coefficient of thermal expansion that is equal to or larger than 2.0 ppm/°C and smaller than 5.0 ppm/°C, and having surface mount terminals, said intermediate board body having a plurality of through holes through which said first and second faces communicate with each other, said intermediate board body containing an inorganic insulating material; and a plurality of conductor columns which filling said through holes and containing a conductive metal, said conductor columns being to be connected with said surface mount terminals, wherein

10

15

20

said method comprises:

a green body producing step of producing a ceramic green body having said through holes;

a metal filling step of filling said through holes with said conductive metal; and

25

a firing step of heating and sintering said ceramic green body and said conductive metal.

27. A method for producing an intermediate board,

5 said intermediate board comprising: an intermediate board body having first and second faces wherein a semiconductor device is to be mounted on at least one of said first and

second faces, said semiconductor device having a coefficient of thermal expansion that is equal to or

10 larger than 2.0 ppm/°C and smaller than 5.0 ppm/°C, and

having surface mount terminals, said intermediate board body having a plurality of through holes through which

said first and second faces communicate with each other,

said intermediate board body containing an inorganic

15 insulating material; and a plurality of conductor columns filling said through holes and containing a conductive

metal, said conductor columns being to be connected with said surface mount terminals, wherein

said method comprises:

20 a first firing step of firing a ceramic green body to produce said intermediate board body;

a metal filling step of filling said through holes of said intermediate board body with said conductive metal; and

25 a second firing step of firing said filled conductive

metal to form said conductor columns.